UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

WO

REPLY TO: 1940 Environmental Statements

FEB 16 1972

SUBJECT: USDA Draft Environmental Statement on Herbicide Control of Sagebrush

TO: Honorable Russell E. Train, Chairman
Council on Environmental Quality

THROUGH: T. C. Byerly, Coordinator of
Environmental Quality Activities

Enclosed are ten copies of the Draft Environmental Statement on Herbicide Control of Sagebrush issued by the Forest Service, Northern Region.

The responsible official is Regional Forester Steve Yurich.

Enclosures

U.S.D.A. FOREST SERVICE ENVIRONMENTAL STATEMENT

HERBICIDE CONTROL OF BIG SAGEBRUSH

Prepared in Accordance with
Section 102(2)(C) of P.L. 91-190

Northern Region

U.S.D.A. FOREST SERVICE ENVIRONMENTAL STATEMENT

Herbicide Control of Big Sagebrush

Prepared in Accordance with
Section 102(2)(C) of P.L. 91-190

Summary Sheet

I. Draft (X) Final ( )

II. Administrative (X) Legislative ( )

III. Brief Description of Action. The action planned is the control of big sagebrush (Artemisia tridentata) with the herbicide 2,4-dichlorophenoxyacetic acid on Beaverhead National Forest rangelands in Madison and Beaverhead Counties, Montana. The statement covers the planned program for F.Y. 1972 and F.Y. 1973. The purpose for control is to increase forage production for domestic livestock and to restore and improve the vegetative ground cover to prevent erosion.

General control areas were proposed originally by the District Ranger and his range-trained assistants while measuring and inventorying range conditions and preparing range allotment management plans. Specific control areas were and are being planned and designated on the ground by the Ranger with the assistance of specialists in ecology, wildlife biology, soil science, landscape architecture, and range science.

The spraying is planned and conducted under strict controls to minimize the impact on the environment.

IV. Summary of Environmental Impacts and Adverse Environmental Effects

The proposed program will alter, on specifically planned areas, the present sagebrush dominated plant community to a grass dominated plant community. This alteration of the vegetative community will have both favorable and adverse effects on the wildlife inhabiting the project areas. It will have a favorable effect on livestock grazing the areas. It will have long-term favorable effects on the soil and productivity of the land.

The introduction of the chemical 2,4-D into the environment for relatively short periods of time has adverse effects on non-target plants. It may also have some effect on animal organisms. When properly planned and conducted, environmental impacts will be minimized.

V. Alternatives Considered

1. Burning.
2. Mechanical control.
3. Use of a different herbicide.
4. Use of a different formulation of 2,4-D.
5. Biological control.
6. Do nothing.
7. Intensive range management alone.
8. Removal of domestic livestock.

VI. A. <u>Federal, State, and Local Agencies, and Individuals from Whom Comments on Sagebrush Control have been Received</u>

1. Bureau of Land Management
2. Montana Fish and Game Department
3. Western Montana College of Education:

    Dr. James E. Short, President

    Donald N. Smith, Professor

    Richard N. Timken, Professor

    Dan Block, Professor

    Dr. Kenneth J. Vandelier, Professor

    Student body on "Earth Day" in 1970

    Conservation groups at the college

4. University of Montana:

    Meyer Chessin, Professor

    Melvin S. Morris, Professor

    Lee E. Eddleman, Professor

5. Butte Free University
6. Montana State University:

    Dr. Gene Payne, Professor

    Don Ryerson, Professor

    Jack Taylor, Professor

7. Skyline Sportsmen's Association
8. District Board of Supervisors, Beaverhead Soil Conservation District

9. Soil Conservation Districts at Sheridan and Ennis
10. Representatives of Agricultural Stabilization and Conservation Service in Bozeman and Dillon
11. Dillon Rotary Club.
12. Dillon Kiwanis Club and Sheridan Kiwanis Club
13. Dillon Chamber of Commerce
14. Executive Board of the State-wide Board of County Commissioners
15. Executive Board of the National Wool Growers Association
16. Executive Board of the National Cattlemen's Association
17. Montana State-wide Agriculture Lenders Group
18. Beaverhead County, Madison County, and Park County rancher groups
19. International Mountain Section of the Society for Range Management
20. U. S. Bureau of Sport Fisheries and Wildlife personnel from the Red Rock Lake Refuge
21. Dubois Sheep Experimental Station personnel

B. <u>Federal, State, and Local Agencies, and Individuals to Whom the Statement will be sent for Comments</u>

1. <u>Federal Agencies</u>

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Agricultural Research Service, Western Region
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(18 copies - This is to cover
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3. Elected Officials

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Honorable Lee Metcalf
United States Senate
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Douglas Smith, Agriculture Coordinator
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4. County - Local Government and Agencies

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5. Organizations, Groups, Universities, and Individuals

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VII. Date Draft Statement made available to CEQ and the public.

FEB 16 197[illegible]

U.S.D.A. FOREST SERVICE ENVIRONMENTAL STATEMENT

Herbicide Control of Sagebrush

Prepared in Accordance with
Section 102(2)(C) of P.L. 91-190

January 1972

Type of Statement: Draft

Date of transmission to CEQ: FEB 1 6 1972

Type of action: Administrative

Responsible official: Regional Forester Steve Yurich
USDA, Forest Service, Region 1
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Missoula, Montana 59801

CONTENTS

I. DESCRIPTION

This environmental statement describes the Forest Service, Northern Region, planned program for control of big sagebrush (Artemisia tridentata) with the herbicide 2,4-dichlorophenoxyacetic acid (2,4-D) during fiscal years 1972 and 1973. The 1972 program has been approved by the USDA Pesticide Coordinating Committee and the Working Group of the Subcommittee on Pesticides. We are including it here for further review of environmental effects.

The sagebrush is sprayed by helicopter with 2 pounds of the low volatile isooctyl ester form of 2,4-D mixed with diesel oil as a carrier. The mixture is applied at the rate of 3 gallons per acre.

A. DEFINITIONS USED IN STATEMENT

1. Spray Area. The specific area actually marked out and sprayed to control sagebrush.

2. Project Area. The planned area for sagebrush control within which spray areas are finally laid out. The range allotment or pasture boundary is the outside line of this area.

3. Program Area. A large land area where spray operations are planned. The Beaverhead National Forest is the program area.

B. ECOLOGICAL SYSTEMS

Big sagebrush grows in association with many forbs and grasses over a wide variety of soil types, elevations, and climate conditions in the Region. The largest continuous areas of sagebrush are found in the Beaverhead National Forest in southwestern Montana. Historical

records and other studies of this area have shown that many of these stands now dominated with 25 or more percent crown cover of sagebrush were originally dominated by grass with only scattered sagebrush.[1,2,3,4] Sagebrush has increased on these stands due primarily to too much livestock use of the more palatable forage plants and other disturbances. In some areas there has been a decrease in total plant cover which has led to increased soil erosion.

The proposed program will alter, on specifically planned areas, the present sagebrush dominated plant community to a grass dominated plant community. It will alter the animal components of the ecosystem as described further in Sections II, III, and IV of the statement.

The effects of the program on the vegetation are expected to last for a period of from 5 to 20 years.[5] Most of the effects on the associated animal species based on past experience are expected to be of shorter duration.

Because of the variations in each particular sagebrush-grass ecosystem, exceptions to many of the expected results and effects described in this statement can occur. The planning of areas to be sprayed, the predicted results, and the description of environmental effects of this program are based on 16 years of experience in controlling sagebrush with 2,4-D on the Beaverhead program area, related research, and the advice of Forest Service and outside specialists in range science, wildlife biology, fisheries biology, soil science, hydrology, forestry, economics, and ecology.

C. PURPOSE

The basic purposes in controlling sagebrush are (1) to increase production of forage for use by domestic livestock, (2) to restore plant cover to hold the soil and prevent erosion, and (3) to restore balance of plant species to more nearly that which occurred before overgrazing caused an invasion of big sagebrush.

D. ORIGIN AND NEED

Sagebrush control projects are originally proposed by the District Ranger when he prepares a range allotment management plan. He has determined that this range improvement method is needed to meet the purposes stated above.

E. OTHER DEMANDS

Basic policy of the U. S. Department of Agriculture calls for all agencies to help in rural area development. The State of Montana looks to Federal Agencies for programs and help to improve the economy of rural rangeland areas. An example of this is the Montana Rangeland Resource Program.[6] There is a constant demand by ranchers for increased summer livestock range. County commissioners ask for programs which will maintain or improve the local economy and the county's income from their share of National Forest receipts. Local chambers of commerce favor actions which are beneficial to the local economy.

F. PLANNED MEASURES TO MINIMIZE ENVIRONMENTAL IMPACTS

1. The minimum amount of herbicide needed to kill sagebrush will be used. This is 2 pounds of 2,4-D (acid equivalent) in a low volatile isooctyl ester.

2. A minimum spray mix of 3 gallons per acre will be used.

3. Spraying will be done by helicopter at an average height of 15 feet above the sagebrush.

4. Spraying will be done during early morning hours with the wind under 6 m.p.h. and the temperature under 68° Fahrenheit. Temperature and wind will be monitored during spray operations.

5. Areas of sagebrush to be sprayed have been or will be carefully mapped out using the advice of Forest Service range conservationists, wildlife biologists, soil scientists, landscape architects, and local State Fish and Game Department wildlife biologists before and during projects.

6. Areas agreed upon will be identified on the ground with minimum 100-foot unsprayed strips adjacent to streams and susceptible hardwood or brush, and 50-foot unsprayed strips adjacent to conifer stands.

7. Flaggers will be used during spray operations to keep the helicopter directly on target between marked spray area boundaries.

8. The mixing of the chemical and carrier will be supervised by an experienced man.

9. The chemical containers will be rendered unusable and disposed of in the closest city municipal State approved sanitary landfill.

10. Spraying will be done during early spring (June in mountainous country) when the plants are growing rapidly.

G. ECONOMIC AND SOCIAL IMPACTS

There will be four direct economic benefits resulting from this program. The first is a stabilization of present beef production or a contribution toward a long-term increase in beef production in the program area. This will, in turn, increase rancher income and contribute toward stabilization of the local economy. The livestock industry is the basis for the economy of the Beaverhead area. This increase in beef production is brought about in a shorter period of time with sagebrush control. The second benefit is the local purchase and delivery of diesel fuel. The third is the income provided employees of the projects. The fourth is the benefits derived from direct income increases being spent in the local area for other services and supplies.

There will be no significant change in the amount or type of human recreational use of the project areas. There can be an effect on the quality of an individual's recreation experience based on his own personal preference. Any improvement in water quality coming from treated areas will enhance downstream recreational values.

One adverse economic impact will occur on seven grazing permittees who will not graze their cattle for a 1-year period. The permittees accept this short-term loss for the added long-term benefits of improved range carrying capacity.

H. ECONOMIC ANALYSIS

This is a benefit-cost analysis bringing all values to present worth.[5/] The costs and forage increases come from recent similar projects on the Beaverhead Forest. The benefit-cost is calculated two ways; (1) using the 1971 average commercial fair market value in the Western States of $3.93 for one animal unit month of forage (A.U.M.) and (2) using the U. S. Forest Service 1966 base grazing fee of $1.23 per A.U.M. The $3.93 is derived from an index of private land grazing lease rates as determined by the Economic Research Service.

1. Project Costs:

Item	Cost to economy per acre	Cost to Government per acre
a. Planning (includes cost of field examination by professional specialists.	$ .50	$ .50
b. Project boundary marking	.20	.20
c. Herbicide	.94	.94
d. Diesel fuel carrier	.59	.59
e. Helicopter rental (fully operated)	1.40	1.40
f. Supervision, flaggers, etc.	.78	.78
g. Equipment use (trucks, pickups, pumps, etc.)	.27	.27
h. Worker expenses, per diem, etc.	.16	.16
i. One year loss of grazing use on project area (Nonuse for season during which sagebrush control is accomplished - to promote rapid recovery of grass density and vigor.)	*1.97	* .61
Total Cost	$6.81	$5.45

*The 1-year loss of forage production is one-half of the yield or 300 pounds, dry weight, per acre. A cow needs 600 pounds, dry weight, of forage per month. Consequently, there will be a loss of one-half A.U.M. per acre. Therefore: 1 year forage loss is $3.93 ÷ 2 = $1.97 and $1.23 ÷ 2 = $ .61.

2. Project Economic Returns. Analysis of increased grass production on six similar projects involving 10,774 acres on the Beaverhead National Forest shows that annual grass production increased on the average from 600 to 1,340 pounds dry weight per acre or an average of 740 pounds per acre.[7] Research has shown similar results in other areas.[5,8,9,10] Assuming 50 percent of this increase will be left for watershed protection and benefits to soil and wildlife, then the remaining 50 percent of the increase is available for livestock use. To arrive at dollar values, we have converted this available increased production to 0.62 A.U.M.'s per acre.* This increase in production is expected to continue for not less than 20 years.[5]

The annual economic return is $2.44 per acre. This is arrived at by multiplying the 0.62 A.U.M. increase by the $3.93 fair market value of one A.U.M. The annual monetary return to the Government is $0.76 per acre. This is arrived at by multiplying the 0.62 A.U.M. increase by the $1.23 Government grazing fee.

The present value of a $1.00 annual income extending over a period of 20 years at a safe interest rate of 5 percent compound interest premise where payments are received at the beginning of the year amounts to $13.08. We can use this figure because grazing fees are collected at the beginning of the year before the grazing season. From this present value of a series of future incomes, we must deduct $1.00 because there will be no income during the first year since the

*740 lbs. ÷ 2 = 370 lbs. 370 lbs. ÷ 600 lbs. (cow need per A.U.M.) = .62 A.U.M.'s

sprayed area will not be used. The remaining value of the expected series of annual incomes is $12.08.

Multiplying the annual economic return of $2.44 times $12.08 (the present worth of expected future incomes) gives an expected economic benefit of $29.48 per acre treated.

Multiplying the expected annual monetary return to the Government of $0.76 times $12.08 (the present worth of expected future incomes) gives an expected monetary benefit of $9.18 per acre treated.

There are additional benefits in decreased erosion, lessened siltation of reservoirs, and both benefits and costs to wildlife. No attempt has been made to assign dollar values to these side benefits and costs.

3. Benefit - Cost Ratio. The calculated benefit-cost ratio to the national economy over a 20-year period would be $\frac{\$29.48}{6.81} = \$4.33$. That is, for every $1.00 expended, the economy would benefit in the amount of $4.33.

The calculated benefit-cost ratio based on direct costs to the Government compared to expected monetary returns over a 20-year period would be $\frac{\$9.18}{5.45} = \$1.68$. That is, for every $1.00 of Government money now expended, the Government can expect future money collections having a present worth of $1.68.

I. SIZE

The proposed 2-year program involves 8,724 acres to be sprayed, distributed among 12 project spray areas within the Beaverhead National Forest. The projects will involve areas within Beaverhead and Madison Counties, Montana. Supplemental information on specific projects is in the appendix. Project locations are shown on maps at the end of this section.

J. LANDOWNERSHIP AND STATUS

All proposed projects are on federally owned land under National Forest administration except 330 acres of privately owned land. This privately owned land within a National Forest grazing allotment was included at the request of the landowner. All cost of herbicide application on this private land will be borne by the landowner.

K. PHYSIOGRAPHY

The project areas are in mountainous terrain at elevations from 6,000 to 7,500 feet. The topography ranges from nearly level to 50 percent slopes. Most of the spray areas lie on slopes between 10 to 30 percent. Project areas occur on all aspects.

L. CLIMATE

Annual rainfall in the program area is normally between 12 and 30 inches, most of which comes as winter snow. Annual yield of the Beaverhead River drainage above Barretts measuring station below Grasshopper Creek is approximately 1.99 inches per acre.[11] The

frost free growing period rarely exceeds 45 days and frosts can occur at any time of the year.

M. SUBSEQUENT MANAGEMENT

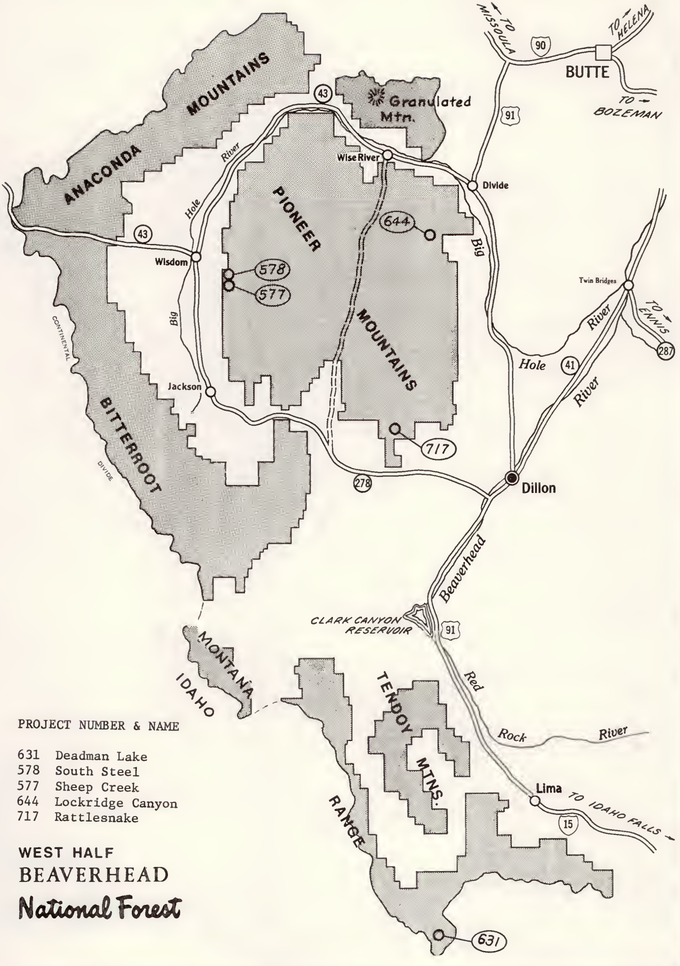
Areas treated with herbicide are rested from grazing use during year of herbicide application and during the growing season of the following year. When grazing is resumed, management is under a rest or deferred rotation grazing system. These systems are designed to maintain the improved range condition achieved through sagebrush control and rest.

N. HISTORY OF PROGRAM

The Forest Service, Northern Region, initiated big sagebrush control through herbicide use in 1955. Through calendar year 1971, an approximate total of 148,000 acres has been treated. One hundred thirty thousand acres have been treated on the Beaverhead Forest. There are no specific figures on total sagebrush acreage on National Forest lands within the Region. For comparison purposes, there is a total of approximately 1,130,000 acres of big sagebrush, with 15 percent or more ground coverage (by weight), in Beaverhead and Madison Counties, Montana. Some method of control has been effected on 234,000 acres, or 21 percent of the total area of dense sagebrush stands in these counties.[12] Fifty-six percent of the 234,000 acres has been done on the National Forest.

Initially, the herbicide application was by fixed-wing aircraft. Since 1959, herbicide application has been by helicopter. Use of

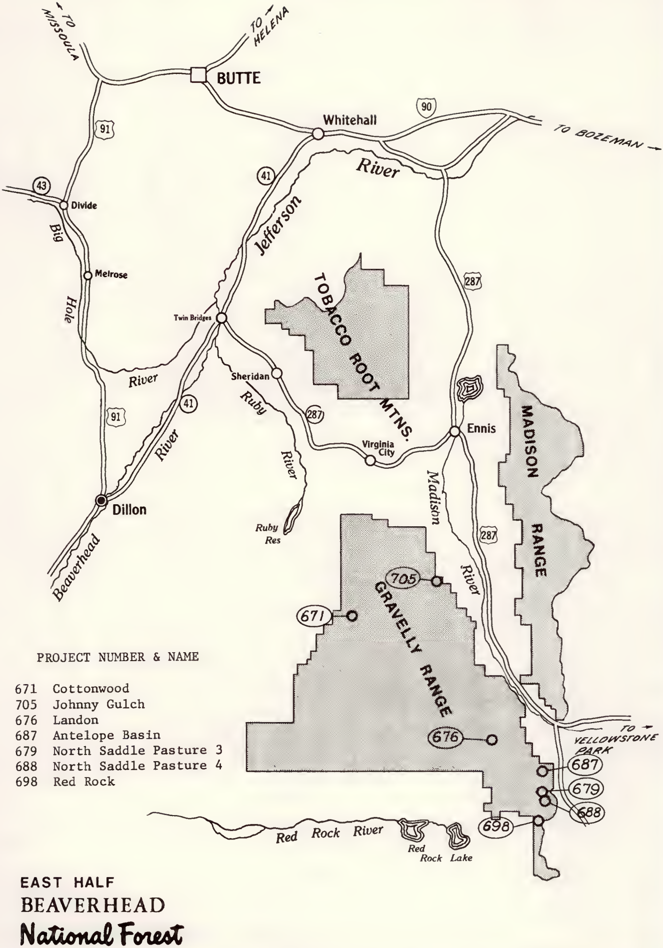
helicopter is more costly, but it has the advantages of low altitude flying which allows more precise control of the chemical thus reducing environmental impacts, more efficient use of the herbicide, and less hazard to the aircraft and its operator.



PROJECT NUMBER & NAME

631 Deadman Lake
578 South Steel
577 Sheep Creek
644 Lockridge Canyon
717 Rattlesnake

WEST HALF
BEAVERHEAD
National Forest



EAST HALF
BEAVERHEAD
National Forest

Photograph 1. Actual spray application of 2,4-D to sagebrush by helicopter. Low elevation flying controls drift. Picture also shows typical mountainous sagebrush-grassland and density of sagebrush being controlled.

Photograph 2. Typical project area showing broad expanses of sagebrush at lower elevations becoming smaller and interspersed with timber at higher elevations.

Photograph 3. Typical stand of sagebrush before spraying with 2,4-D. Control action is limited to range sites having dominant sagebrush crown cover, a good understory of grasses, and high productive capability.

Photograph 4. Same area as photograph 3 after control of big sagebrush. Note large increase in grasses.

II. ENVIRONMENTAL IMPACTS

A. AIR

There will be an introduction of 2,4-D and diesel into the air over the spray areas by volatilization and drift. Control measures such as use of low volatile ester and others listed in Section I of this statement are planned to minimize this impact.

B. SOIL

From research results, we can expect approximately 6 parts per million (p.p.m.) of 2,4-D to be deposited in the surface inch of soil in the treated areas.[13] This small amount should cause little or no impact on soil micro-organisms.[13] Soil micro-organisms are very important in the degradation of 2,4-D.[14]

Removing sagebrush cover temporarily allows more exposure of the soil to splash action from any high intensity rainstorms that may occur until vegetative cover is restored.

There will be two temporary physical impacts on the soil. The first is the hand brush clearing of 10- to 50-foot diameter helispots when necessary. The second is the surface disturbance that results from off-road vehicular travel to helispots. Vehicle damage should be limited to crushed grass and slight soil compaction. To minimize this impact, the clearings and vehicle use will be held to the minimum needed.

C. VEGETATION

About 100 to 300 parts per million (p.p.m.) of actual 2,4-D are expected to be deposited on or absorbed by the ground vegetation.[13] Decay of 2,4-D reaches 94 percent in 5 weeks.[13] Other research has shown that 2,4-D rapidly decays in soils.[15,16] The diesel fuel carrier is also biodegradable and research has shown that it degrades within 6 months.[17] There will be a change in the percent of different plant species in the community.

1. Sagebrush. Percent of sagebrush kill based on actual measurements of similar past projects on the Beaverhead Forest, is expected to be from 65 to 95 percent. Research has shown similar results.[18,19] Dead sagebrush will remain present from 6 to 10 years, depending on the moistness of the site. Some reestablishment of sagebrush can occur on some sites. There are no planned measures to minimize this impact.

2. Grass. There will be an increase in total grass production and vigor in the sprayed areas.[5,8,9,10,19,20] Expected increases in grass production will range from 490 to 932 pounds (dry weight) per acre.[7,10] There are no planned measures to minimize this impact.

3. Forbs. Many forb plants will be killed by 2,4-D. Some species are not affected. Some after crown death, will resprout from the roots the next year. Table 1 shows the presently known effects on various forb species.[21] There are no planned measures to reduce this impact on forbs within the spray areas.

TABLE 1. MORTALITY OF PLANTS ON AREAS SPRAYED WITH 2,4-D TO CONTROL BIG SAGEBRUSH[1]

Species	Mortality[2]
Shrubs and Trees	
Amelanchier alnifolia	Heavy
Artemisia cana	Moderate
Artemisia tripartita	Heavy
Ceanothus velutinus	Unharmed[3]
Pinus contorta	Light
Populus tremuloides	Light[3]
Potentilla fruticosa	Unharmed
Prunus virginiana	Light[3]
Pseudotsuga menziesii	Unharmed
Purshia tridentata	Light
Salix spp.	Light[3]
Symphoricarpos oreophilus	Light[3]
Tetradymia canescens inermis	Unharmed
Forbs	
Achillea millefolium	Unharmed
Agastache urticifolia	Light
Agoseris spp.	Moderate
Antennaria microphylla	Light
Aplopappus sp.	Unharmed
Arnica fulgens	Light
Astragalus convallarius	Unharmed
Astragalus miser praeteritus	Unharmed
Astragalus salinus	Unharmed
Astragalus stenophyllus	Heavy
Balsamorhiza sagittata	Heavy
Forbs (Cont.)	
Calochortus macrocarpus	Unharmed
Castilleja spp.	Heavy
Comandra umbellata	Light
Crepis acuminata	Unharmed
Delphinium depauperatum	Unharmed
Delphinium glaucescens	Unharmed
Erigeron corymbosus	Light
Erigonum heracleoides	Light
Eriogonum ovalifolium	Unharmed
Geranium viscosissimum	Unharmed
Helianthella uniflora	Heavy
Linum lewisii	Unharmed
Lithospermum ruderal	Moderate
Lupinus caudatus	Heavy
Lupinus leucophyllus	Moderate
Mertensia oblongifolia	Heavy
Opuntia polyacantha	Unharmed
Penstemon radicosus	Light
Penstemon spp.	Heavy
Perideridia gairdneri	Unharmed
Phlox canescens	Light
Potentilla spp.	Heavy
Rumex sp.	Unharmed
Senecio integerrimus	Light
Geum triflorum	Heavy
Solidago sp.	Unharmed
Viola spp.	Unharmed
Zigadenus paniculatus	Heavy

[1] Blaisdell, J. P. and Mueggler, W. F., 1956. Effects of 2,4-D on Forbs and Shrubs Associated with Big Sagebrush. Journal of Range Management, 9:38-40.

[2] Ratings: Unharmed, light, 1 to 33 percent kill; moderate, 34 to 66 percent kill; heavy, 67 to 100 percent kill.

[3] Severe damage to aerial portions, but few plants completely killed--almost all sprouted profusely.

4. Shrubs. The chemical will crown kill some other shrubs and hardwood plants present in the spray area. The chemical drifting may kill some species adjacent to the spray area. Shrubs vary greatly in their sensitivity to 2,4-D. Some will crown kill easily. Some will resprout again from the roots. Table 1 shows the known effects on shrubs.[21] Measures planned to minimize this impact are described in Section I. Additional precautions will be taken to protect the unsprayed strips in all areas where drift is more likely to move.

5. Trees. Lodgepole pine in spray areas may be killed. Growth of Douglas-fir and limber pine can be impeded for 1 or 2 years. The measures previously described to carefully lay out, mark, and control drift to certain areas will minimize this impact. In addition, the helicopter pilot will be instructed not to spray when flying over small patches of trees within spray areas.

6. Aquatic Vegetation. There will be little or no impact on aquatic vegetation when chemical is applied under the control measures stated. If by accident, a large amount of chemical gets directly into live water, aquatic plants may be killed. Measures to keep spray out of live water include buffer zones, flagging, and others previously listed.

D. WATER

Even under the controls of spraying, there may be minute amounts of chemical enter directly into open streams, lakes, or ponds. On brush

spraying operations in Oregon, the maximum amount that drifted into open water was .01 p.p.m.[13] In this same project where spraying occurred over open water, the maximum contamination was .1 p.p.m.[13] We expect contamination in this project to be .01 p.p.m. or less due to the avoidance of spraying on any open water. If a very heavy rainfall occurs immediately after spraying, some chemical may be carried into streams. The planned 100-foot unsprayed strip should stop most or all of the surface flow.

Project area 717 lies within the city of Dillon's municipal watershed and projects 577 and 578 lie within one of the city of Butte's municipal watersheds. Applied as planned, there will be no known impact on these water supplies. The fact that no spraying will be done over live water, the time it takes for any surface or subsurface flow that may be present to reach the water intake, and the rapid rate of degradation of 2,4-D lead to the conclusion that no harmful amounts of chemical will get into the water supply. Detailed coordination and planning of these projects to assure water supply safety are being done by the Beaverhead Forest with the municipalities involved.

There will be an impact on the quality of water infiltrating spray area soils from snowmelt during a brief period in the spring. There is conflicting research on whether this will be increased or decreased. Some evidence shows that removal of the sagebrush allows more snow to accumulate and more water to enter the soil by a reduction in water

loss through evaporation.[22,23] Other evidence shows that infiltration into the soil is restricted by continuous concrete frost formations over open grassland that do not form under sagebrush cover.[22,24]

There will be an increase in the quantity of water infiltrating the soil during the remainder of the year caused by converting the vegetation from brush to grass.

E. VISUAL APPEARANCES

There will be a change in appearance of the landscape of the treated areas from the visable dominance of live sagebrush to a visable dominance of grass and dead sagebrush. After 6 to 10 years, the dead sagebrush will not be apparent. There are no planned measures to minimize this impact.

There will be a visual impact of diesel storage tanks at the helispots 6 months before and until spraying is complete. These are placed in the fall when the ground is dry. They cannot be moved into the areas in the spring because of wet soils. There are no planned measures to minimize this impact.

F. SOUNDS AND SMELLS

There will be noise caused by the use of a helicopter. There are no planned measures to minimize this impact.

There will be a smell of 2,4-D and diesel fuel during and for a few days after treatment.

There will be a reduction in the smell of sagebrush in the treated areas.

G. <u>HUMAN HEALTH</u>

Project workers will be exposed to the chemical 2,4-D and diesel fuel. Precautions taken to minimize this impact include regular changes of clothing, washing all chemicals off hands before eating, and off the body at the end of each workday.

H. <u>ANIMALS</u>

There will be an impact on livestock grazing capacities of the sprayed areas.

There will be direct and indirect impacts on wildlife in the spray areas. Direct impacts are the toxicity of the chemical, noise, and disturbance. Indirect effects are caused by the changing of wildlife food and cover. Table 2 gives an overall view of the relative impacts on wildlife using a simple + and - system. Details of effects on wildlife will be covered in Sections III and IV of this statement. Measures listed under Section I, Description, are planned to minimize the impact on wildlife.

I. <u>CLIMATE</u>

This program will cause no noticeable effect on the general climate of the areas. There will be a change in the microclimate of the specific spray areas. Effects of this change on specific soils, plants, and animals are unknown.

TABLE 2. RELATIVE POSSIBLE IMPACTS OF SAGEBRUSH CONTROL WITH 2,4-D APPLIED UNDER CONTROLLED CONDITIONS ON WILDLIFE FOUND IN THE PROJECT AREAS.

+ favorable effect   - adverse effect   0 no apparent effect   U unknown effect

	Food summer	Food winter	Cover	Toxicity	Water
Birds					
1. Song					
Sandhill Crane	U	0	U	0	0
Brewer Sparrow	0	0	-	0	0
Other	U	U	U	0	0
2. Game					
Sage grouse	-	0	-	0	0
Blue grouse	+	0	+	0	0
3. Raptors	-	0	0	0	0
Large Mammals					
1. Carnivores					
Coyote	-	0	0	0	0
Bears	0	0	0	0	0
Other	0	0	0	0	0
2. Game					
Elk	-	+	-	0	0
Deer	-	0	-	0	0
Antelope	-	0	-	0	0
Moose	-	0	0	0	0
Small Mammals					
1. Jackrabbits	-	-	-	0	0
2. Rodents	-	0	0	0	0
Amphibians and Reptiles	U	0	U	U	0
Insects					
1. Terrestrial	U	0	U	U	0
2. Aquatic	0	0	0	0	0
Fish	0	0	0	0	0

III. FAVORABLE ENVIRONMENTAL EFFECTS

A. AIR

This program will not have any known favorable effects on air quality.

B. SOIL

The long term expected favorable effects to the soil due to converting vegetative cover to grass from sagebrush are:

1. An increase in organic matter content in the surface few inches.

2. Increased earthworm and soil micro-organism activity.

3. Increased porosity due to increased pore space, caused by more roots and root channels and increased earthworm activity.

4. Improved soil structure due to root activity, increased organic matter content, and earthworm activity.

5. Reduced erosion hazard due to vegetative cover preventing crusting and soil detachment caused by direct raindrop impact.

C. VEGETATION

There will be a long term favorable effect on herbaceous vegetation from this program. The removal of sagebrush makes more water, nutrients, and space available for other plants.

D. WATER

Following the spraying of sagebrush, an increase in grass density is expected. The increased density of the grass plants and decomposing plant parts will help intercept rain droplets--thus reducing the energy necessary to cause splash erosion. The favorable effects

on the soil resulting from conversion of vegetative cover to grassland type are described under B. SOIL in this section. These favorable effects help to improve the soil's existing infiltration rate--thus increasing the soil's ability to resist erosion from running water. The effect of the increased grass density to reduce erosion can reduce the amount of sediments entering streams, thereby improving stream water quality.

There is a possible favorable effect on the quantity of water infiltrating the soil during spring runoff as described in the third paragraph under D. WATER in Section II.

E. VISUAL APPEARANCES

The long term visual change that will occur in the landscape from continuous sagebrush to a mosaic of sagebrush and grasslands is a favorable environmental effect. This opinion is based on principles of perceiving the visual resource found in the Northern Region Forest Landscape Management Handbook, Volume One.[25]

F. SOUNDS AND SMELLS

There are no known favorable effects on sounds or smells from this program.

G. HUMAN HEALTH

There are no known favorable effects on human health.

H. ANIMALS

The reduction of sagebrush, the restoration of desirable range forage plants and the increase in grass, caused by the program, will result in an increase in livestock grazing capacity of the areas. This grazing capacity will be used to stabilize or allow an increase in the numbers of domestic livestock grazing the range.

Controlling sagebrush will increase the degree of interspersion of vegetation types. This is a long term favorable effect on wildlife by providing a wider variety of wildlife habitat types and increasing the amount of "edge" effect.[26]

Following are known, or possible, favorable effects that may occur on five wildlife species or groups of species:

1. Blue Grouse. Blue grouse are found in or near all project areas. These grouse, being primarily seed eaters, benefit with increased summer food and grass cover.

2. Elk. Elk will benefit with an increased grass food supply on winter range on projects Nos. 723, 705, 578, 577, and 676. Elk also benefit from increased grass food supply during the remainder of the year on all projects.

3. and 4. Raptors and Coyotes. A possible favorable effect on raptorial birds and coyotes is a temporary increase in their food supply of rodents due to the removal of rodent protective cover.

5. Rodents. There is an improvement in habitat for meadow voles and other rodents that are primarily grass eaters.

IV. ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

A. AIR

The introduction of small amounts of 2,4-D and diesel into the atmosphere will cause some air pollution. This cannot be avoided because there is no known spray method that will not volatilize some and put some of the spray mixture into fine droplets that will drift into the air. In addition, the chemical can volatilize back into the air from the surface of the plants or soil.[13,27] How serious this amount of 2,4-D and diesel entering in the atmosphere is on other life systems is not known.[27] The adverse environmental effects on air will be temporary since the droplets containing the 2,4-D eventually combine with atmospheric particles and are washed out of the atmosphere to earth or water surfaces.[27]

B. SOIL

Most of the degradation of 2,4-D occurs after it goes into plants or is deposited on the soil. It is broken down by plant metabolism, soil micro-organisms, hydrolysis, photo decomposition, and chemical decomposition.[14,28] The acetic acid is broken down first, followed by the chlorine, and finally the phenol ring. Each of these is broken into products not harmful to plants or animals. Only through degradation can the environment eventually get rid of the chemical.[13,27]

The possible adverse effect of splash action of raindrops from a high intensity storm could cause soil loss through erosion. The risk of this is low because the spray areas chosen have a good understory of herbaceous vegetation, the sagebrush stalks will remain,

and the competition release causes grasses to respond quickly. The temporary risk here we consider worth taking to receive the longer term benefits to soil mentioned under B. SOIL in Section III.

The minor damage to the soil caused by clearing small helispots and minimum vehicle use cannot be avoided because access is needed for the projects. The soil will recover from these effects very rapidly.

C. VEGETATION

The most serious adverse effect on the sagebrush-grassland vegetation is that 2,4-D kills many forbs and other shrub plants. This effect cannot be avoided because the species killed are susceptible to 2,4-D and are growing intermixed with sagebrush. It is not practical to control large areas of sagebrush by hand spraying and even with hand spraying, some forbs are killed.

This reduction of numbers of forb and other shrub plants changes the proportion of plant species in the sagebrush-grassland ecosystem.[21,29] Forbs will begin to return to the plant community over various periods of time. There is a lack of good quantitative data on how long it takes forbs to return to the plant community and in what amounts. One report states that forb populations seem to be regained in 3 to 5 years.[20] Preliminary results from another study comparing sprayed and unsprayed areas indicate longer recovery times, at least for some species.[30] The effect of the reduction of forbs and shrubs on wildlife is discussed in this section under H. ANIMALS.

The killing of lodgepole pine trees and damaging of other conifers will be limited to the specific project areas where scattered trees occur. This will be a very small amount of individual trees that cannot be avoided in spraying operations.

D. WATER

The expected .01 p.p.m. of herbicide that may enter open water will lower water quality some. This small amount of change in water quality has not been found to effect any living organisms using the water. If as much as 1.0 p.p.m. should get into streams because of accident or a heavy unexpected rainfall, aquatic insects and plants may be harmed.[14] One study has shown no effect on aquatic algae with full saturation of water (220 p.p.m.).[31] Because of water dilution, it would take amounts much larger than the application rate and 2,4-D would have to be placed directly into the streams to harm fish, larger animals, or man.[13]

There is a possible adverse effect on the quantity of water infiltrating the soil from spring snowmelt as described in the third paragraph under D. WATER in Section II. This effect would only cover small acreages and occur under certain climatic conditions conducive to ice formation which changes from year to year. The benefit of increased water infiltration the remainder of the year outweighs this possible adverse effect. There is also evidence that the reverse is true, hence this environmental effect was discussed under both Sections III and IV.

E. VISUAL APPEARANCES

The immediate change in landscape appearance from live to dead sagebrush is adverse when viewed from close range. This effect lasts for a few years until the grasses increase in heighth and begin to soften the appearance of dead sagebrush.[25]

The appearance of large diesel storage tanks in the project areas for 6 months is adverse.

Both adverse effects are temporary and will not be observed by a large number of people because of the remoteness of the project areas from recreational use areas.

F. SOUNDS AND SMELLS

The helicopter noise will affect a few project workers and occasional visitors and disturb native wildlife species present in the area. This temporary noise pollution is unavoidable. Because of the early morning spraying, time of year, and isolated areas being treated, this impact will be minimized.

The odor left by 2,4-D and diesel is gone in a short time. Whether this smell is offensive or not is an individual's subjective opinion. The effect would be on the few project workers, visitors, and wildlife in the area.

The reduction of the smell of sagebrush could be adverse or favorable, depending on personal opinion.

G. HUMAN HEALTH

There is always some hazard to human health in the use of toxic chemicals.[32] This hazard is primarily accidental exposure of the skin to large amounts of the 2,4-D when mixing or handling. The chemical can also enter the body through inhalation or directly into an open wound. There will be no exposures heavy enough to cause harm when the chemicals are handled according to project plans.

2,4-D is not passed up the food chain like other chemicals.[14] It is rapidly excreted by animals[13] and because of its rapid degradation is not considered a serious human health hazard.

H. ANIMALS

Table 2 under Section II of this statement shows in very general terms there will be adverse effects on 10 wildlife species or groups of species. Most of these effects are temporary, lasting only the year of the spray operation, or for possibly 2 to 5 years following spraying. More serious effects and for longer periods may occur on sage grouse, antelope, and deer if sagebrush is removed from critical wintering, strutting, nesting, or other special habitat areas needed by these species. On the specific project areas, all the known critical wildlife habitat areas have been identified and removed from the planned spray areas. This was done on the ground by Forest Service and State wildlife biologists and the District Ranger responsible for the management of the area.

The possible adverse toxic effect of the chemical 2,4-D on any animals and fish, including both terrestrial and aquatic insects, is considered minor. Reasons for this are:

1. The known amounts needed to harm any specie are far in excess of what is applied.[13,33] See Tables 3 and 4.

2. Any chemical ingested by animals or birds is rapidly excreted and does not build up in the food chain.[13,14]

3. The chemical degrades rapidly in the animal.[13]

The direct adverse effects of noise and disturbance to all wildlife are very temporary and of minor importance.

There is a possible toxic effect on grazing animals caused by an increase in nitrates that may occur in some plants after spraying.[34,35,36] This increase does not always occur and there are natural conditions that cause increases in nitrate.[34] The nitrate, when eaten by the animal, changes to nitrites in the intestinal tract. These nitrites can interfere with the transport and use of oxygen causing suffocation. The seriousness and extent of this effect is not fully known. The chances of this occurring with livestock on the project areas are remote because they are kept off of sprayed areas a full year or more.

The following are known, or possible, adverse effects that may occur on 10 wildlife species or groups of species as a result of vegetational changes:

TABLE 3. ACUTE TOXICITY OF HERBICIDES[1]

Organism	2,4-D
Birds:	
LD_{50}, mg/kg	260-2000
No effect, p.p.m.[2]	720[3]
Rodents:	
LD_{50}, mg/kg	375-800
No effect, p.p.m.[2]	1500
Ruminants:	
LD_{50}, mg/kg	400-800
No effect, p.p.m.[2]	2400[3]
Other Mammals:	
LD_{50}, mg/kg	100
No effect, p.p.m.[2]	500
Fish:	
TL_m, p.p.m.[4]	1-60
No effect, p.p.m.[5]	0.1[6]
Other aquatics:	
TL_m, p.p.m.[4]	1-5
No effect, p.p.m.[5]	0.1[6]

[1]Norris, Logan A., 1971. Chemical Brush Control: Assessing the Hazard, J. of For., Vol. 69, No. 10, pp. 715-720.

[2]Concentration in diet for a limited exposure period which causes no acute effect.

[3]Assumes daily food consumption is 10 percent of body weight and that 20 percent of LD_{50} in daily diet has no acute effect.

[4]Forty-eight hour median tolerance limit, i.e., the concentration of herbicide in the water which will kill 50 percent of an exposed population of aquatic organisms in 48 hours.

[5]Concentration in water which has no acute effect following 48 hours' exposure.

[6]Assumes 10 percent of TL_m has no effect.

TABLE 4. CHRONIC TOXICITY OF HERBICIDES[1]

Herbicide and Organism	Dose mg/kg	Equivalent Concentration in Diet[2] p.p.m.	Duration days	Effect
2,4-D				
Mule Deer	240	2400	30	Slight
Cattle	50	500	112	None
Sheep	100	1000	481	None

[1]Norris, Logan A., 1971. Chemical Brush Control: Assessing the Hazard, J. of For., Vol. 69, No. 10, pp. 715-720.

[2]Assumes food intake is 10 percent of body weight per day.

1. Brewer Sparrow. This sparrow nests in sagebrush and numbers have declined in sprayed areas.[37] We expect a reduction in carrying capacity for these birds in the sprayed areas due to removal of nesting sites. There will be no effect on the sparrows living in adjacent unsprayed sagebrush stands. The effect will last in the sprayed areas until sagebrush returns to a density necessary for nesting.

2. Sage Grouse. Sage grouse depend on sagebrush for both food and cover.[29,38,39] They depend on numerous forbs for summer food.[29,38,40] Sage grouse summer range occurs in project areas Nos. 631, 577, and 578. There is no known sage grouse winter range or strutting grounds within the spray areas. The removal of sagebrush and forbs in these project areas will probably cause most of the sage grouse to move to adjacent sagebrush stands for a period of 2 to 5 years or longer if the forbs do not recover. As forbs and sagebrush begin to return to the sprayed areas, more sage grouse should begin to use the areas again. The total cumulative effect of sagebrush removal has not been known to reduce the sage grouse numbers in the program area.

3. Raptors. The project areas are within the range of several groups of raptorial birds including the golden eagle, red tailed hawk, marsh hawk, and several species of owls. The adverse effect that may occur on raptors is that rodent populations may be lowered due to the removal of forbs. However, the removal of sagebrush cover

may make rodents more available to raptors thus increasing their food supply. The effect on the total number of these birds is unknown.

4. Coyotes. Since the coyote subsists mainly on rodents and small animals for food, some adverse effect on their food supply may occur. This effect, we believe, is temporary and not serious because of small sprayed acreages, rapid rodent population recovery, and large range of the coyotes. As with raptors, the removal of sagebrush cover may make rodents more available immediately and actually improve overall habitat for coyotes.

5. Elk. Elk use all the project areas during the summer months. One adverse effect on elk is the reduction of preferred forbs from their summer range. This cannot be avoided because the forbs are intermingled with the sagebrush. The elk will likely make less use of these sprayed areas until the preferred forbs return. The removal of these areas from elk summer range, we do not consider critical because of the abundance of summer range in the project areas.

Another possible adverse effect on elk is the modifying of sagebrush cover on favored calving grounds. Known calving areas will not be sprayed. Within each project area there will be left unsprayed sagebrush. (See individual project descriptions in appendix for acreage figures.) Much of this is left as buffer zones along timber types. Leave areas should be adequate for elk preferring to calve in sagebrush.

Project areas 705, 578, 577, and 676 contain parts of elk winter range. Sagebrush areas on ridge tops that would be needed by elk during tough winters have been removed from the spray area. Favorable effect of increased grass on these projects should outweigh the possible adverse effect.

6. Deer. Mule deer winter range is found on projects 577, 578, 644, 671, 717, and 705. Here sagebrush is important to deer for food. These areas have been removed from the proposed spray areas.

An adverse effect that cannot be avoided is the reduction of preferred forbs from deer summer range within the project areas. This effect will last until the preferred forbs return to the plant community. Reduction of forbs from summer range is not considered serious because some forbs are still present in the sprayed areas and the abundance of forbs on adjacent unsprayed areas.

Another adverse effect on deer is the removal of dense sagebrush cover that may serve as fawning or resting areas. We believe that substitute areas can be found on adjacent sagebrush stands. Deer have been observed using the improved grass cover in sprayed areas.

7. Antelope. During the summer, antelope occasionally use project areas 631, 577, 687, 698, 679, 688, and 717. The unavoidable adverse effect is through the removal of sagebrush and forbs used as food.[41] This effect will last until forbs and some sagebrush return, but is not considered serious because of sufficient remaining

antelope summer range. The antelope migrate from the areas during the winter.

8. Moose. Moose are found in all of the project areas. Reduced forbs on sprayed areas will cause reduction in summer food for moose.[42] This effect is considered temporary and not significant because of sufficient forage on adjacent unsprayed areas and other vegetation types such as aspen that are more favorable to moose.[2]

9. Jackrabbits. Jackrabbits utilize sagebrush for food and cover along with other forbs and shrubs in the sagebrush-grass community. Spraying will reduce the carrying capacity of these project areas for jackrabbits. The extent of this reduction is unknown.

10. Rodents. The population of pocket gophers will likely be reduced because of the removal of forbs; their primary food.[43] Other rodents will be affected to the extent of the habitat alteration. For example, there may be a change from a favored habitat for deer mice (primarily seed eaters) to an improved habitat for meadow voles (primarily grass eaters). The extent of this change in rodent populations is unknown.

V. ALTERNATIVES TO THE PROPOSED ACTION

The following alternatives to sagebrush control with 2,4-D are being considered. Where necessary, comparisons of the environmental effects of the alternatives in chart form follow each brief description.

1. Burning. There are two possible times during the year when this may be done - early spring and late summer. Early spring burning will do less resource damage. Burning is difficult to schedule into an intensive range management plan. Also, suitable conditions for spring burning cover only a few days in this mountainous area and in some years do not occur at all.

ALTERNATIVE 1 - BURNING

	ENVIRONMENTAL EFFECTS		
	Favorable	Adverse	Other Factors
Air	No 2,4-D into air.	Puts smoke pollution into air. Hot burn on fine textured soils will cause an impermeable layer for a short period.	Smoke can be put into upper atmosphere by burning under proper conditions.
Soil		Increases soil exposure and erodibility for 1-2 years by removing mulch.	Cooler burn can control some of the amount of mulch burned.
Vegetation	Immediate release of nutrients. Forbs recover faster.	Too hot fire can destroy more important plants. Kills all conifers and top kills other shrubs. Risk of fire escape.	Fire heat can be controlled some with spring burn. Same effect on long-term pattern of vegetation.

	ENVIRONMENTAL EFFECTS		
	Favorable	Adverse	Other Factors
Water	No 2,4-D into water.	Possibility of more sediment into stream. Possible ash pollution of water.	
Visual	Removes dead sage plants. No diesel storage tanks.	Looks bad the year burned.	
Sounds & Smells	No noise pollution. No 2,4-D smell.	Smoke smell.	
Human Health & Economics	Less cost to do jobs.	Inhalation of smoke and eye irritation. Larger economic impact on permittees from keeping cattle off longer. Risk of fire escape.	Much more difficult to schedule into intensive range management system. Many areas do not lend themselves to burn safely.
Animals	More variety of forbs recover faster. New growth attracts wildlife. No 2,4-D on animal life. Creates more interspersion of vegetative types than spraying.	Completely destroys vegetation for wildlife for 1 year. Can catch and burn some small animals and birds.	Wildlife will move out of these areas as they do in spray.
Climate		Short-term effect on microclimates greater than spray.	

Based on the preceding comparison, burning is still being considered as a viable alternative where ground conditions will permit it.

2. Mechanical Sagebrush Control. This category includes all known methods developed to dig out or break down sagebrush. These include plowing, railing, chaining, rotary choppers, and rolling choppers. Each method requires one to three heavy tractors to pull the mechanical implements and are limited to slopes under 30 percent and without excessive surface rock.

If plowing were chosen, reseeding of grass and forb species would be necessary. This method is usually used only in severely depleted ranges where native plant recovery would be very slow. All of the ranges in the planned program area have enough native plants to recover without reseeding.

ALTERNATIVE 2 - MECHANICAL CONTROL

	ENVIRONMENTAL EFFECTS		
	Favorable	Adverse	Other Factors
Air	No 2,4-D into air.	Possible dust pollution into air.	
Soil	Puts more organic material on ground to decay faster.	Light to heavy disturbance of soil mantle. May increase soil exposure to erosion.	Must be done on flat slopes with little or no rock.
Vegetation	Forbs will return faster under some methods. Trees and some other shrubs can be avoided. Railing destroys less forbs.	Disturbs or destroys all smaller plants. Faster reinvasion of sagebrush.	No change in fire hazard.

	ENVIRONMENTAL EFFECTS		
	Favorable	Adverse	Other Factors
Water	No 2,4-D into water.	More sediment may enter stream from destruction of ground cover.	
Visual Appearance	Removes dead sagebrush appearance. No diesel storage tanks.	Surface destruction. Looks bad for 1 year.	
Sounds & Smells	Noise is not as loud. No 2,4-D or diesel smell.	Noise lasts for much longer periods of time.	
Human Health & Economics	No chemical health hazard.	Costs are considerably higher to do job.	
Other Animals	No 2,4-D on animal life. Forbs recover faster.	Destroys habitat for 1 year. May kill some small animals and birds.	All other wildlife effects similar to chemical control.
Climate			Probably similar to spraying.

From this analysis we do not consider mechanical methods a viable alternative in this program area.

3. Use of a Different Herbicide. There are a great number of herbicides that kill sagebrush. It is beyond the scope of this statement to cover in detail all these chemicals and their possible environmental effects. There is no chart comparison for this alternative. 2,4-D was chosen because:

a. To our knowledge all of the effects on the environment will be less with 2,4-D than the effects of other herbicides.

b. It is the most selective chemical known from Region 1 experience in sagebrush control.[44]

c. It degrades faster than other chemicals suitable for sagebrush.[13]

d. It is approved for agricultural and rangeland use by the U. S. Department of Agriculture and is registered for the use we are making of it.

e. It is cheaper than many other chemicals.

f. It mixes or emulsifies well with diesel carrier.

Use of other chemicals under present knowledge is not considered a viable alternative.

4. Use of a Different Formulation of 2,4-D. There are many other possible formulations of 2,4-D. Three that could be used in this program are:

a. 2,4-D amine salts mixed with water.

b. 2,4-D high volatile ester mixed with diesel.

c. 2,4-D isooctyl ester mixed in an invert emulsion with water.

The amine salt is less effective in killing sagebrush and more pounds of chemical would be placed into the environment. The high volatile ester drifts very badly and kills too many nontarget plants outside the desired spray areas. Forest Service policy states that high volatile esters will not be used because of drift.

An invert emulsion applied through a bi-fluid system offers both advantages and disadvantages:

Advantages

1. Less diesel oil is needed as carrier.
2. Sharper control of drift.
3. Less volatilization of chemical.
4. Spraying can be done under higher wind and temperature conditions.
5. Less 2,4-D is needed to get a kill.

Disadvantages

1. The equipment is more complex.
2. Present contracts for helicopter, diesel fuel, and herbicide would need revision and new contractors may have to be sought.
3. Changing the present helicopter contract hours could affect the cost of the entire Region 1 helicopter contract. Region 1 has one contract for all helicopter use.
4. Total cost would be higher.
5. The presence of the emulsifier needed will retard the degradation of 2,4-D in the environment.[27]

The invert emulsion method is still being investigated and will be considered as an alternative for the program area.

5. Biological Control. There are no known, developed and tried biological organisms to control sagebrush.

6. Do Nothing. This alternative is to continue with the present season-long grazing system and no sagebrush control would be done.

There would be no immediate change in the environment. However, there would be a long-term change in vegetation and soil toward poorer conditions and less food production for both domestic and wild animals. Eventual erosion would lower the productive capacity of these lands and bring less benefits to the nation. This alternative is not viable.

7. Intensive Range Management Alone. This alternative consists of changing the range management system of use from season-long grazing to a rest or deferred rotation grazing system capable of improving the vegetation and soil conditions, but without spraying sagebrush.

The analysis of this alternative is shown on the following chart:

ALTERNATIVE 7 - INTENSIVE RANGE MANAGEMENT ALONE

	ENVIRONMENTAL EFFECTS		
	Favorable	Adverse	Other Factors
Air	No 2,4-D into air.		
Soil	Maintains soil fertility.		
Vegetation	No forb kills. No tree or other shrub damage.	No assured remo-moval of heavy sagebrush cover from the ecosystem.	No change in fire hazard.

	ENVIRONMENTAL EFFECTS		
	Favorable	Adverse	Other Factors
Vegetation (cont.)		Sagebrush robs more productive forage plants of moisture and nutrients.	
Water	No chemical into water.	None	Timing or amount of water release would be same as spraying with management.
Visual Appearance	No storage tanks.	Continuous, heavy sagebrush not as pleasant as mosaic of grass and sage.	
Sounds & Smells	No sound pollution. No 2,4-D or diesel smell.		
Human Health & Economics	No health hazard.	Economic impact on permittees and on local economy over a long-term period. No increased short-term employment.	No change in recreational use of land.
Other Animals	No short-term adverse effects on wildlife.	Long term - no development of wider variety of habitat types for animal life.	Wildfires may replace chemical control of sagebrush.
Climate	No effect on microclimates.		

From this comparison, this alternative will be considered viable on a project by project basis.

8. Removal of Domestic Livestock. This alternative would have the advantage of preventing all of the adverse effects of chemical

control of sagebrush. It would have a severe economic effect on the grazing permittees depending on these areas for summer grazing. It may put them out of business. It would take decades for the areas to reach climax vegetation where there would be less sagebrush and would keep the project area's productivity very low. Since there are other more viable alternatives, this one should only be considered as a last resort.

VI. RELATIONSHIP BETWEEN SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE OF LONG-TERM PRODUCTIVITY

The long-term products from the treated areas and the effect this program will have on them are:

1. Clean Air. There will be no change in the present production of clean air from the treated areas.

2. Stable Soils. There will be a gradual improvement in the long-term production of stable soils on the treated areas.

3. Food for Domestic Livestock. There will be an increase in the long-term production of food for domestic livestock on the treated areas.

4. Food and Cover for Wildlife. There will be an increase in the long-term production of food and cover for some wildlife species and a decrease for others in the treated areas.

5. Clean Water. There will be a long-term improvement on the quality of water coming from the areas.

6. Natural Beauty. The long-term effect on natural beauty depends on each viewer's personal opinion.

VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

This program will cause no known irreversible or irretrievable commitment of resources.

VIII. CONSULTATION WITH OTHERS

A. AGENCIES, GROUPS, AND INDIVIDUALS CONSULTED AND SUMMARY OF COMMENTS RECEIVED

The following groups, organizations, and individuals indicated, after consultation, that they were opposed to control of sagebrush with 2,4-D.

1. State of Montana Fish and Game Department.
2. Western Montana College of Education:
   Donald N. Smith, Professor
   Richard N. Timken, Professor
3. University of Montana:
   Meyer Chessin, Professor

The following groups, organizations, and individuals indicated, after consultation, they were not completely opposed to the control of sagebrush with 2,4-D. They did show concern that increased caution should be exercised when using chemicals, such as 2,4-D. They feel that it is a toxic chemical, like aspirin, and that it should be wisely used. They were concerned about the environmental impacts, particularly on the animal and birdlife, and their habitats. They also showed concern about the half life and decay of 2,4-D.

1. Skyline Sportsmen's organization from Butte.
2. Butte Free University.
3. A minority of the student body from Western Montana College on "Earth Day" in 1970.

The following groups, organizations, and individuals indicated, after consultation, that they were generally in favor on the control of sagebrush by spraying with 2,4-D.

1. Bureau of Land Management.
2. District Board of Supervisors of the Beaverhead Soil Conservation District.

3. Representatives of Agricultural Stabilization and Conservation Service in Bozeman and Dillon.

4. Western Montana College:

   Dr. James E. Short, President
   Dan Block, Professor
   Dr. Kenneth J. Vandelier, Professor

5. Conservation groups at Western Montana College.

6. A majority of the student body at Western Montana College on "Earth Day" in 1970.

7. University of Montana:

   Melvin S. Morris, Professor, Range Management
   Lee E. Eddleman, Professor, Range Management

8. Montana State University:

   Dr. Gene Payne, Professor, Range Management
   Don Ryerson, Professor, Range Management
   Jack Taylor, Professor, Range Management

9. Dillon Rotary Club.

10. Dillon Kiwanis Club and Sheridan Kiwanis Club.

11. Dillon Chamber of Commerce.

12. Executive Board of the State-wide Board of County Commissioners.

13. Executive Board of the National Wool Growers Association.

14. Executive Board of the National Cattlemen's Association.

15. Montana State-wide Agriculture Lenders Group.

16. Beaverhead County, Madison County, and Park County rancher groups.

17. International Mountain Section of the Society for Range Management.

18. U. S. Bureau of Sport Fisheries and Wildlife personnel from the Red Rock Lake Refuge.

19. Personnel from Dubois Sheep Experimental Station.

20. Soil Conservation Service Districts at Sheridan and Ennis.

B. AGENCIES, GROUPS, AND INDIVIDUALS TO WHOM THE STATEMENT WILL BE SENT

1. Federal Agencies

Charles C. Fanher
Agricultural Research Service, Western Region
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Oakland, California 94612

John Green, Regional Administrator
Region 8 Environmental Protection Agency
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Denver, Colorado 80203

Dr. Raymond T. Moore, Acting Commissioner
Environmental Control Administration
Department of Health, Education, and Welfare
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Jack O. Horton, Deputy Assistant Secretary for Programs
U. D. Department of Interior
Washington, D.C. 20240
(18 copies - This is to cover
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Bureau of Land Management
National Park Service
Bureau of Reclamation)

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Cooperative Extension Service
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Billings, Montana 59101

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Portland, Oregon 97205

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Dillon, Montana 59725

2. State Agencies

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Department of Natural Resources and Conservation
Helena, Montana 59601

Director
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Helena, Montana 59601

Director
Montana Department of Public Health
Helena, Montana 59601

Director
Montana Highway Department
Helena, Montana 59601

Perry Roys, Director
Montana Department of Planning and Economic Development
Helena, Montana 59601

Willis B. Jones, Chairman
Montana Fish and Game Commission
Suite 410, Petroleum Building
Helena, Montana 59601

LeRoy Ellig, District Manager
Montana Fish and Game Department
Bozeman, Montana 59715

Fletcher Newby, Director
Montana Environmental Protection Agency
Helena, Montana 59601

3. Elected Officials

Honorable Mike Mansfield
United States Senate
Washington, D.C. 20510

Honorable Lee Metcalf
United States Senate
Washington, D.C. 20510

Honorable Richard G. Shoup
House of Representatives
Washington, D. C. 20515

Douglas Smith, Agriculture Coordinator
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Capitol Building
Helena, Montana 59601

4. County - Local Government and Agencies

Ray Lynch, Mayor
City of Dillon
Dillon, Montana 59725

Mayor
City of Butte
Butte, Montana 59701

Board of County Commissioners
Beaverhead County
Dillon, Montana 59725

Board of County Commissioners
Madison County
Virginia City, Montana 59755

5. Organizations, Groups, Universities, and Individuals

Skyline Sportsman Association
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President
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Ennis Lions Club
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APPENDIX I. INDIVIDUAL PROJECT DESCRIPTIONS

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631 Deadman Lake

This project includes portions of Deadman Creek, Henderson Gulch, and Nicholia Creek which are tributaries of Big Sheep Creek along the northeast slope of the Beaverhead Mountains. The project area contains 3,275 acres of sagebrush range with a perennial grass understory. In the spring of 1972, we plan to spray 945 acres of the dense sagebrush on the most productive sites. We will leave 2,330 acres of low density sagebrush and sagebrush areas that are important summer habitat for sage grouse. The project area is largely open grassland with occasional small stands of Douglas-fir. The project is generally on a northwest exposure with slopes ranging from 0 to 40 percent and averaging about 10 to 15 percent.

577 Sheep Creek and 578 South Steel

These two projects join each other and are located on portions of Steel Creek, Francis Creek, Sand Creek, and Sheep Creek drainages on the west slope of the Pioneer Mountains. The project areas contain 1,446 acres of sagebrush range with a perennial grass understory. In the spring of 1972, we plan to spray 1,200 acres of sagebrush of which 334 acres are being controlled on private land under cooperative agreement. There will be 246 acres of sagebrush left as unsprayed zones to protect streams and other vegetative types. Douglas-fir stands border the projects on the east side and open sagebrush and grasslands border on the west. These projects are

on a west exposure with slopes ranging from 0 to 40 percent and averaging about 15 to 20 percent.

644 Lockridge Canyon

This project is located in the Trapper Creek drainage on the east slope of the Pioneer Mountains. The project area contains 759 acres of sagebrush range with a perennial grass understory. In the spring of 1972, we plan to spray 444 acres of sagebrush. There are 315 acres reserved for key winter deer range or for unspray zones to protect streams or other vegetative types. Douglas-fir stands border the proposed project area and are used by game as cover. In general, the project is on a south exposure with slopes ranging from 0 to 45 percent and averaging about 15 to 20 percent.

717 Rattlesnake

This project includes a portion of the Rattlesnake drainage and several of the smaller tributaries that feed into Rattlesnake Creek. The project area lies on the south end of the Pioneer Mountains and contains approximately 4,800 acres of sagebrush range with a perennial grass understory. In the spring of 1973, we plan to spray 2,226 acres of dense sagebrush on the most productive sites. We will leave 2,574 acres of sagebrush type in scattered blocks and unspray zones adjacent to streams and other vegetative types. Sagebrush control will be done in various size blocks dispersed throughout an area of about 14,000 acres. The project is generally on a south and east

exposure with slopes varying from flat to about 50 percent and averaging about 20 percent.

671 Cottonwood

This project includes portions of smaller tributaries that feed into the Ruby River. The project area lies on both sides of the Ruby River and includes portions of the lower slopes of the Gravelly Range on the east side of the river and the lower slopes of the Snowcrest Range on the west side of the river. The project area contains approximately 2,448 acres of sagebrush range with a perennial grass understory. In the spring of 1972, we plan to spray 1,000 acres of dense sagebrush on the most productive sites. We will leave 1,448 acres of sagebrush within the project area for primary deer winter range, low density stands, and unsprayed zones adjacent to streams and other vegetative types. The sagebrush control will be done in various sized blocks dispersed throughout the project area on the benches above the river. The spray areas are either on an east or west exposure on gentle slopes ranging from 5 to 30 percent and averaging about 15 percent.

705 Johnny Gulch

This project is located at the upper end of Johnny Gulch which is a tributary to the Madison River and lies along the east slope of the Gravelly Range. The project area contains 365 acres of sagebrush range with perennial grass understory. In the spring of 1973, we plan to spray 252 acres of dense sagebrush on the most productive

sites. We will leave 113 acres of sagebrush as unsprayed zones adjacent to other vegetative types. The project area is largely open country with small clumps and stringers of Douglas-fir on the north slopes and in the bottoms of the drainages. The spray areas are either on a north or south exposure on gentle slopes ranging from 5 to 20 percent and averaging about 15 percent.

676 Landon

This project is located on the benches and lower slopes near the mouth of the West Fork of the Madison River and lies along the east slope of the Gravelly Range. The project area contains 1,832 acres of sagebrush range with perennial grass understory. In the spring of 1972, we plan to spray 836 acres of dense sagebrush on the more productive sites. We will leave 996 acres of sagebrush within the project area as unsprayed zones to protect streams and other vegetative types and also areas that have been identified as important for elk calving areas. The spray areas are generally on an east exposure on gentle slopes ranging from flat to 25 percent and averaging about 15 percent. This project will complete the sagebrush control program in the West Fork of the Madison drainage.

687 Antelope Basin

This project is located on the slopes and rolling hills in the Antelope Creek drainage and lies on the southeast end of the Gravelly Range. The project area contains 970 acres of sagebrush range with a perennial grass understory. In the spring of 1972, we plan to spray 810 acres

of dense sagebrush stands on the more productive sites. We will leave 160 acres of sagebrush as unspray zones to protect other vegetative types and also stands of low density sagebrush. The project area is in open country with an occasional clump of Douglas-fir on the ridges and patches of aspen in the swales. The spray areas are on a west exposure on gentle slopes ranging from 5 to 30 percent and averaging about 20 percent.

<u>679 North Saddle Pasture 3 and 688 North Saddle Pasture 4</u>

These two projects join each other and are the second and third year of a project that is being sprayed in stages over a four-year period. The project area is located on Antelope Creek and Poison Creek drainages on the southeast end of the Gravelly Range. Project number 679 contains 322 acres of sagebrush range with perennial grass understory. In the spring of 1972, we plan to spray 226 acres of sagebrush on the more productive sites and will leave 96 acres of sagebrush as unsprayed zones to protect streams and other vegetative types.

Project number 688 contains 375 acres of sagebrush range with perennial grass understory. In the spring of 1973, we plan to spray 125 acres of dense sagebrush on the more productive sites. We will leave 250 acres of low density sagebrush stands and unspray zones to protect streams and other vegetative types. The spray areas are on a northwesterly exposure on slopes ranging from 5 to 30 percent and averaging about 20 percent.

698 Red Rock

This project is located on the head of several unnamed tributaries that drain into the Red Rock River on the south end of the Gravelly Range. The project area contains 779 acres of sagebrush range with perennial grass understory. In the spring of 1972, we plan to spray 660 acres of dense sagebrush on the most productive sites. We will leave 119 acres of sagebrush as unsprayed zones to protect other vegetative types. The area is generally open grassland with occasional clumps of Douglas-fir on the ridges and aspen patches in the swales. The spray areas are on a westerly slope on slopes ranging from 5 to 30 percent and averaging about 15 percent.

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APPENDIX II. LITERATURE CITED

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